Carbon Nanotube Electronics

Yu-Ming Lin
IBM T. J. Watson Research Center
Yorktown Heights, NY 10605

Carbon nanotubes (CNTs) are promising candidates for nanoelectronic technology because of their exceptional electrical transport properties, including ballistic 1D transport, a high Fermi velocity, and high current carrying capability. Field-effect transistors using semiconducting carbon nanotubes have been shown to possess very impressive performance comparable to or even exceeding that of state-of-the-art Si-based transistors. Carbon nanotube field-effect transistors (CNFETs), however, still have some disadvantageous issues that need to be addressed. In particular, due to the Schottky barriers formed at the metal/nanotube interface, CNFETs exhibit ambipolar behaviors upon scaling, resulting in large OFF-state currents and a shallow switching slope. I will review important factors determining the transport behavior and performance of a CNFET. I will then introduce gate structure engineering concepts in CNFETs and discuss how we can eliminate these problems by selectively doping the contact regions via electrostatic doping or chemical doping. In collaboration with: Joerg Appenzeller, Zhihong Chen, and Phaedon Avouris.